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# A REPORT
## on
## Czchow Dam

Prepared by
Project Treasure Island
for
Directorate of Intelligence, USAF
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This report contains information requested on the Czchow Dam on the Dunajec River in Poland, which serves for control of flood and navigation and for power production.

The information submitted is the result of a study of French, German, Polish and Slovak open sources, published between 1935 and 1952, and listed in the attached bibliography. The most valuable information was found in the sources listed under Nos. 1 and 2. However, very little graphic material on this dam is available. (The construction of the dam was started by the German Occupation Authorities.)

The report was compiled in accordance with the P.W.D. questionnaire as follows:

I. Functions

A. The system of which the dam forms a part

See Figs. 1 and 3. The Czchow Dam on the Dunajec River is one of a system of dams built by the Polish Government on the Wisla (Vistula) River and its affluents. Their function is to control flood and navigation on the upper Vistula River, the electric power production being only of a secondary nature.

B. The dam within the system

The Czchow Dam forms the tailwater reservoir for the main dam in Roznow, 13 km upstream from Czchow. The Czchow Dam has three functions:

(1) Control of flood;

(2) Control of navigation;

These two functions are obtained by the coordinated operation of the Czchow and Roznow Reservoirs.

(3) Power production.

1. Control of flood

For the control of flood the Czchow Reservoir's capacity of 15,000,000 cu m permits a regulation of flow within every 24 hours, while the 230,000,000 cu m storage capacity of the Roznow Reservoir assures a regulation of flow from season to season.

2. Control of navigation

The Czchow Dam and Reservoir serve to coordinate the irregular discharge from the Roznow Reservoir. The Roznow Power Plant is operated as a peak-load plant and uses a 24-hour pondage within a period of 6 to 8 hours of the daily peak-load demand. (See separate report on the Roznow Dam).

Only during these peak-load hours is the water discharged from the Roznow Reservoir into the Czchow Reservoir. Thus, the functions of the Czchow Reservoir are: to receive the peak-load flow from the Roznow Reservoir and to discharge it in 24 hours into the Dunajec River through the Czchow base-load plant and/or over the Czchow Dam spillways. An improvement of navigation on the Vistula River by lowering its level at high water and raising it 25 cm in time of drought or low water is thereby achieved.

3. Power production

The third function of the Czchow Dam and Power Plant is power production. Czchow operates as a base-load power plant for the transmission line Roznow-Czchow-Tarnow (Moscice)-Warsaw (Fig. 3).

C. Highways and railways resting on the dam or adjacent thereto

No information available.

D. Navigation locks in connection with the dam

No navigation locks were built as the Dunajec River is not navigable.

II. Location and designation

A. Data which will make possible pinpointing the installation

See map, Fig. 1. Czchow is in the province of Cracow (Wojewodztwo Krakowskie), county Nowy Sacz (powiat Nowosadecki). It is located on the Dunajec River, 43 km north of Nowy Sacz, 13 km downstream from the Roznow Dam.

B. Official, local, and popular names of dams and dependent installations

Czchow.

III. Dimensions

A. Dam (Fig. 2)

1. Maximum and minimum head on dam

Maximum head is 9 m.

2. Maximum and minimum depth of water below dam

No information available.

3. Total height of dam above river bed and above foundations

Height above river bed is 13 m.

Height above foundations is 23 m.

4. Elevation of bottom of penstocks at dam

There are no outside penstocks, only intakes built into the dam.

5. Total thickness at base and at high water level

No information available.

6. Slopes of dam faces

No information available.

7. Length at crown, across river bed and along spillway

Length at crown is 430 m,

Length along spillway is 94 m.

B. Reservoir

1. Capacity

Total capacity is 15,000,000 cu m.

2. Area

No information available.

3. Length, width, and depth (including profiles)

No information available.

4. Detailed plan in vicinity of the dam

The valley at the dam and reservoir is surrounded by foothills of the Beskid Mountains. The elevation of these hills does not exceed 420 m. They are covered with pine forests (Fig. 2).

C. Navigation locks in connection with the dam

No navigation locks were built in this dam.

IV. Hydrological data

The catchment area of the Dunajec River extends into the High Tatra Mountains to elevations of 2,600 m and into the Beskid Mountains to elevations of 1,200 m. It comprises a 4,850 sq km area for the Dunajec River with all its affluents and of 2,080 sq km for the Dunajec River alone.

The yearly precipitation in this area ranges from 900 mm in the foothills to 1,200 mm in the Tatra Mountains. An exceptionally heavy rainfall of 700 mm in one month occurred in 1934.

Dunajec River has all characteristics of a mountain stream, i.e., a wide difference between average and high flow, steep incline, and it carries a considerable amount of silt and boulders.

Flow characteristics of the Dunajec River are:

| | |
|---|---|
| Minimum flow | 5 cu m/sec |
| Medium flow | 44 cu m/sec (180 days a year) |
| High flow | 1,400 cu m/sec (every four years) |
| Unusual peak flow | 3,500 cu m/sec (July, 1934); |
| Average flow | 60 cu m/sec |

The high water can be stored in the Roznow Reservoir, and released when necessary through the Czchow Reservoir and Dam. Unusual flood peaks, like in 1934, can be reduced from 3,500 cu m/sec to 2,600 cu m/sec.

The yearly discharge varies greatly, according to records kept from 1914 to 1935. With the exception of the unusual flood year of 1934, the water discharge varied from 940,000,000 cu m in the dry year of 1917 to 3,280,000,000 cu m in 1926.

V. Foundation conditions and soil characteristics under and near the dam

The central and upper strata of the Tatra Mountains consist of Jura limestone, which in its upper layers is superimposed with crystalline rock, mostly granite. North of the town of Nowy Sacz, the Dunajec River breaks in a deep cut through a very wide zone of flysch, which consists of a thick deposit of sandstone belonging to the early Tertiary System, and in part to the Cretaceous and Permian Systems. The sandstone is partly uniform and partly of conglomerate structure. Between the layers of sandstone are layers of clay slate. Faulted strata are frequently encountered.

The Czchow Dam is built in this flysch zone. The river bed is filled 10 m deep with boulders of various sizes, below which lies sandstone. The various layers of the bottom rock form an angle of 20 to 25 degrees with the axis of the dam. Thus different sections of the dam stand on different layers of rock. This created difficulties in the laying of foundations. The subsoil conditions made it necessary to build a grouting curtain. Deep bores in the rock under the foundations were filled with grout under pressure. The porous rock is highly absorbent.

VI. Design data

A. Structural type or types

Czchow Dam is a solid gravity dam with control gates (Fig. 2).

B. Materials used

Information on materials used on Czchow Dam is not available but it seems reasonable to assume that materials used for the construction of the Roznow Dam were also used for Czchow. Plastic concrete was used with sand of grain sizes graded from 0 to 80 mm. Concrete was produced on the spot; sand and gravel for the mix were obtained from the river bed. The quantity of Portland cement per cu m of concrete is 300 kg on the upstream face of the dam, and 250 kg in other sections of the dam.

C. Design criteria

No available information on stresses.

D. Details and equipment (penstocks, control gates, inspection galleries, cranes, etc.)

Spillways

The 94-m long spillway section of the dam, is composed of six separate blocks, forming six spillways, each 12.7 m wide and 7.5 m high, closed by taintor gates.

VII. Special data on power dams

A. Capacity (kva), present and proposed

Installed

10,000 kw (1942)

B. Output (KwH/yr) achieved and proposed

The proposed output was 47,000,000 kwhr. Utilization time - 4,700 hrs a year (1939).

C. Powerhouse

1. Location; 2. Structure; 3. Installations; 4. Number, dimensions location and type of penstocks.

No information available.

D. Places or installations served; ties with power grids

The Czchow Hydroelectric Power Plant is connected by a 150-kv single transmission line with Moscice (Tarnow) and Warsaw. It is also interconnected with the peak load hydroelectric power plant at Roznow and thermal power plants at Moscice and Nisko. Due to the adoption of Soviet high-voltage norms in Poland it was proposed (1946) to convert the 150-kv single transmission line to double 110-kv lines. The Roznow-Czchow-Warsaw high-voltage transmission line is a part of the power

grid, planned for Poland before the war (Fig. 3) and greatly developed during the 6-Year-Plan in Poland.

E. Location and description of transformer yards and transmission system

Information not available.

VIII. Historical data

A. Name and background of the designer

No information available.

Construction plans formed an integral part of the Roznow Dam plans since the Czchow Dam was to supplement the Roznow Dam, both in water control and in power production.

B. Dates of construction

Work on the dam began in the spring of 1938. There are no data as to when the Czchow Dam was completed and put into operation.

C. Sources of materials

Portland cement - from Polish cement factories.

Concrete - produced in own mixing yard.

Steel rods and shapes - from Polish steel plants.

Power plant equipment - mostly from German firms.

D. Records of war damage, failures, removal of equipment, etc.

No information available, except that most of the drawings and blueprints were destroyed during the German campaign in Poland and had to be replaced during the German occupation.

E. Data on conditions of structure at any date

Latest data on the construction is of June 1939. Information concerning the proposed change of voltage of the Roznow-Czchow-Warsaw transmission line is dated December 1946.

F. Proposals for enlargement, alteration or extension of functions

Except for the above projected change of voltage from 150-kv to 110-kv, no such plans are known.

IX. Graphical material

A. Photographs, especially those taken during construction

A photograph attached to this report is shown in Fig. 2.

B. Working drawings, general and detailed

Not available.

C. Record and publication drawings

Drawings attached to this report are shown in Figs. 1 and 3.

D. Sketches by persons who have seen installations

Not available.

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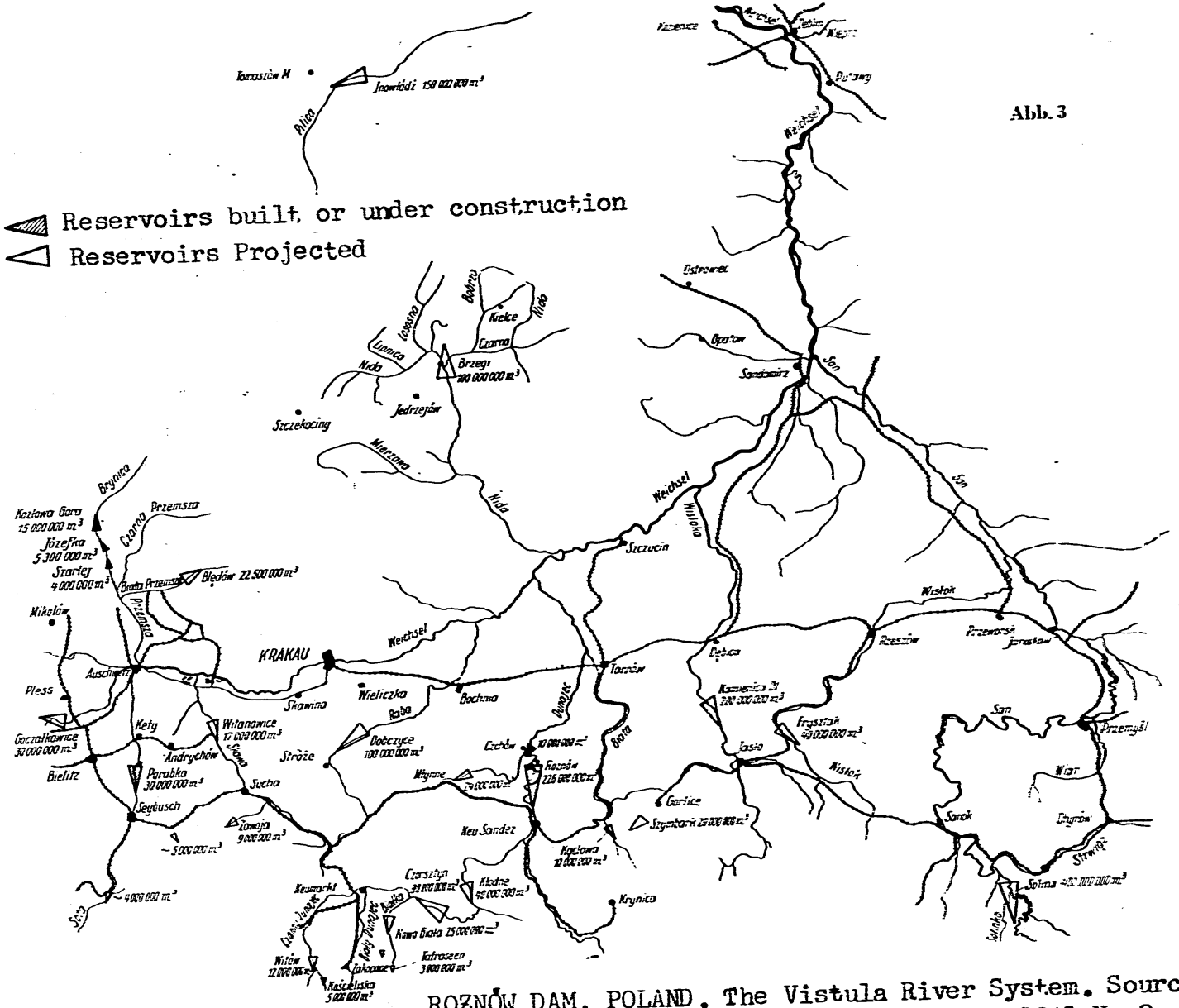
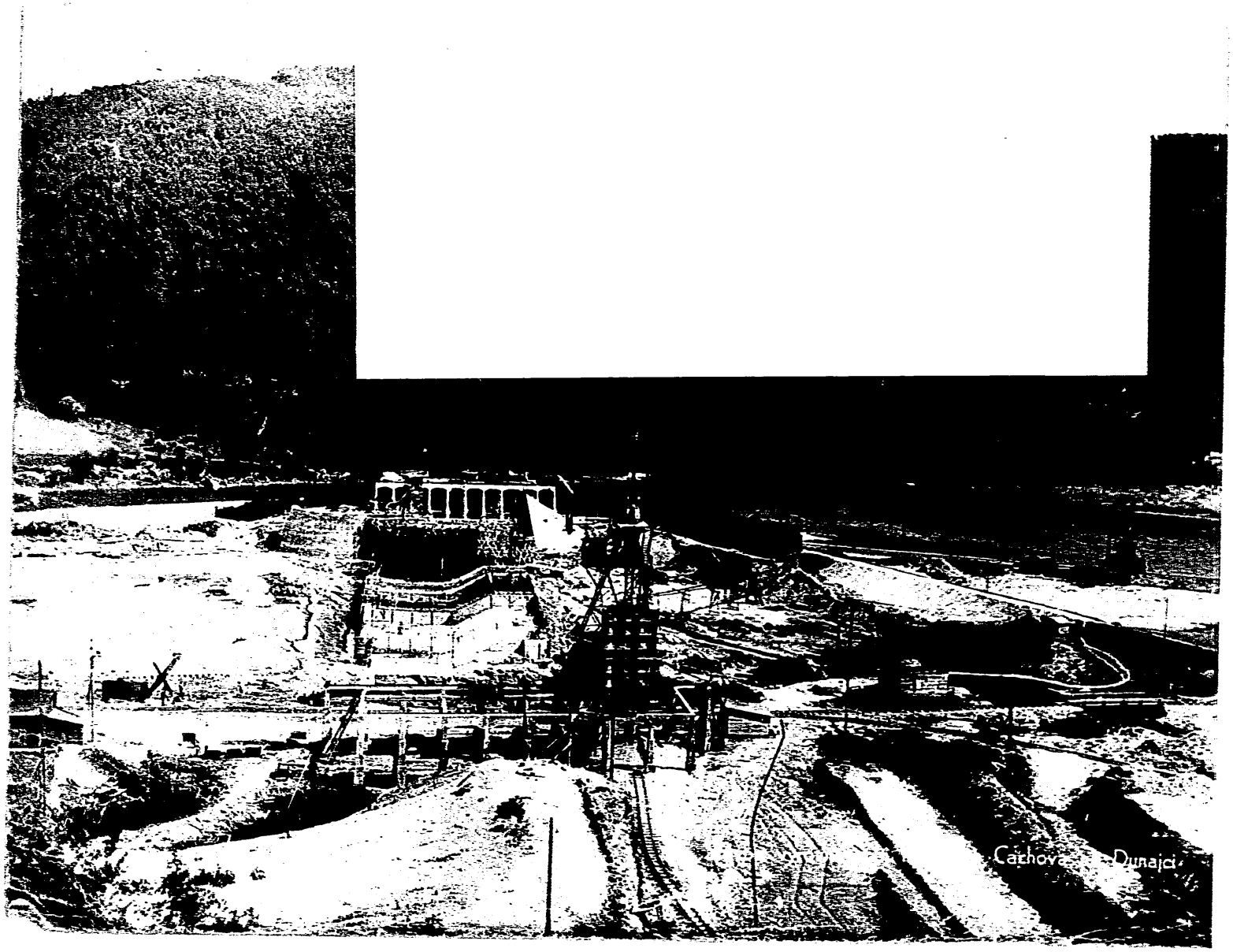



ROZNÓW DAM, POLAND. The Vistula River System. Source: Deutsche Wasserwirtschaft, Munich, Febr.1941,No.2,p.65



CZCHOW DAM, POLAND. Dam Under Construction. Source: Technik (Bratislava), 1949, No.2-6, back cover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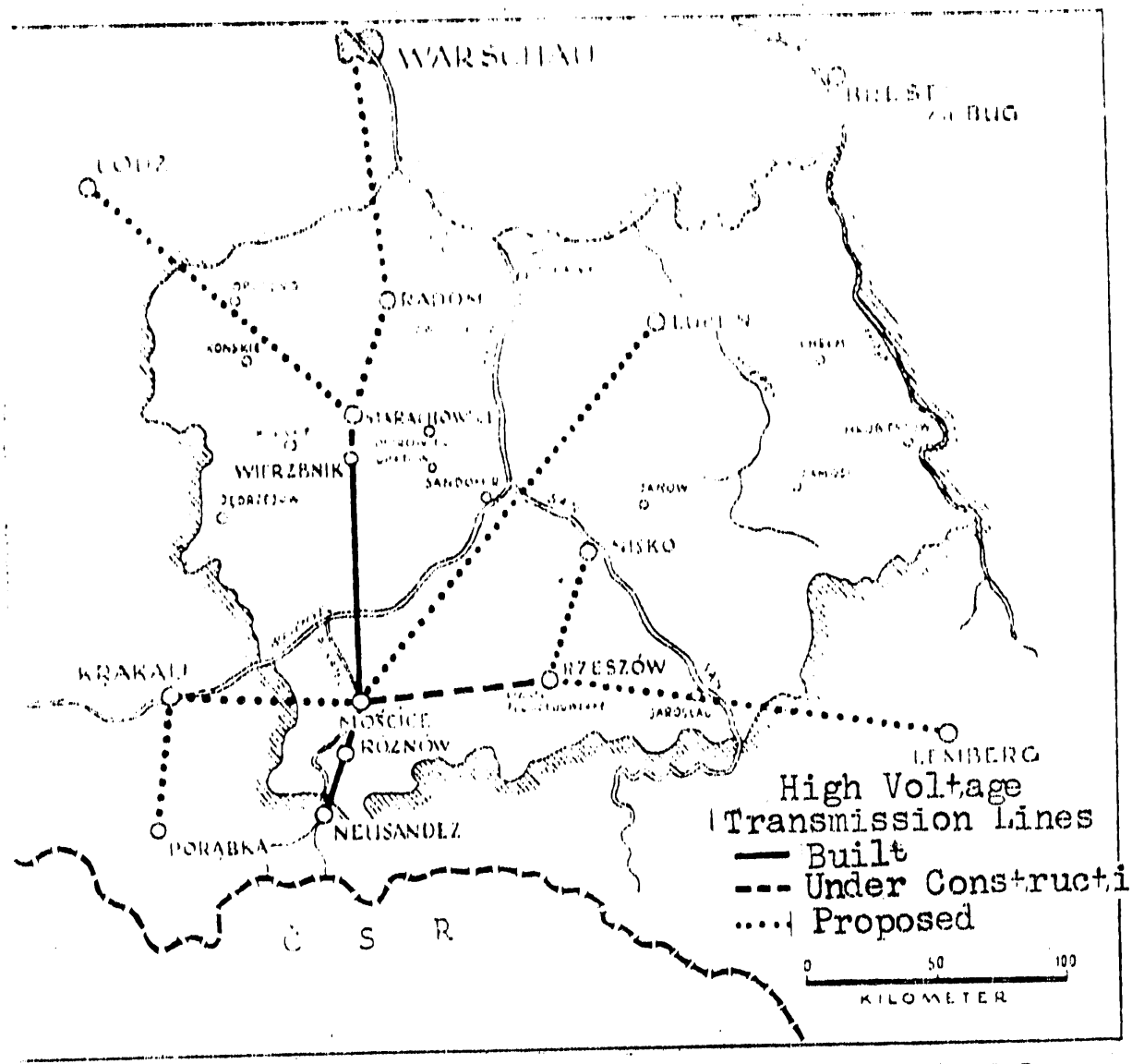


PORABKA, ROZNOW, AND CZCHOW DAMS, POLAND. High Voltage Transmission Lines in the Central Industrial Region of Poland, as of end of 1937. Source: Ostland Institute, (Danzig),"C.O.P. Das Zentrale Polnische Industrierevier." 1938, p. 25